

Application
for
United States Patent

To all whom it may concern:

Be it known that, Drew Van Norman
has invented certain new and useful improvements in

PUMP DRIVE ALIGNMENT APPARATUS AND METHOD

of which the following is a description:

PUMP DRIVE ALIGNMENT APPARATUS AND METHOD

FIELD OF THE INVENTION

[0001] The invention relates generally to assembly and alignment methods for mechanical devices such as for example positive displacement pumps. More particularly, the invention pertains to connecting and aligning a motor and gear drive assembly to a pump assembly.

BACKGROUND OF THE INVENTION

[0002] Positive displacement pumps are in wide use in industry. For example, pumps such as positive displacement pumps are often used in manufacturing to pump materials such as food ingredients or other products through various material carrying lines used in processing of foods or other items.

[0003] Some conventional pump arrangements utilize a motor and gear box or gear drive assembly that is coupled to the pump assembly so that the motor/gear box drives the pump assembly. In those circumstances, the motor/gear box needs to be operatively coupled to the pump assembly. For example, in one known arrangement, a base plate is provided to rest on a work surface. The motor/gear box device is bolted down to the base plate and has a drive shaft extending therefrom. The pump assembly is also bolted down to the base plate with another shaft extending from the pump assembly.

[0004] These two extending shafts point towards each other, and are then aligned as best as they can be aligned so that a coupling device couples the shafts together. Since it is practically impossible to align the two shafts perfectly, the shaft coupling typically is some form of a flexible coupling and may be for example, a rubber or a plastic spider coupling.

[0005] Typically, it will be appreciated that the motor/gear box assembly and the pump assembly are each affixed to the base plate using bolts. To accomplish this, each have a footing with a plurality of bolt holes which are larger than the bolts themselves permitting lateral adjustments before the bolts are tightened. However, in practice it has been found that the alignments achieved by these conventional methods still permits some degree of misalignment, whether angular misalignment or offset misalignment, between the axes of the two respective shafts. Misalignment leads to wear and stresses in the motor/gear box component, the pump component and/or on the coupling. Also, the couplings tend to be subject to wear and need replacement.

[0006] Further, aligning the two shafts is typically a time consuming and difficult procedure. First, the motor/gear box device and the pump need to be arranged in such a fashion so as to align the shafts. Then, both components must be maintained in this alignment while the bolts which attach the motor/gear box device and the pump assembly, respectively, to the base plate are tightened.

[0007] Accordingly, it would be desirable to provide an alignment device and method that could align a motor/gear box component with a pump component with an improved degree of accuracy and/or repeatability. It would also be desirable for such a device and method to be simple and convenient to use.

SUMMARY OF THE INVENTION

[0008] The foregoing needs are met, to a great extent, by the present invention, wherein in one aspect an apparatus is provided that in some embodiments provides an alignment device and method that can align a

motor/gear box component with a pump component with an improved degree of accuracy and/or repeatability.

[0009] In accordance with one embodiment of the present invention, an adapter for connecting a motor/gear box assembly to a pump assembly comprises an adapter body comprising a first face having a counter bore that receives a nose projecting from the motor/drive assembly, a second face having at least two mounting holes that each receive a registration device such as a shoulder screw threadable into the pump assembly, and a bore extending from the front face to the second face through the adapter to permit a shaft to pass therethrough between the pump and the motor/gear box assembly.

[0010] In accordance with another embodiment of the present invention, an adapter for connecting a motor/gear box assembly to a pump assembly comprises a first face having means for receiving a nose projecting from the motor/gear box assembly, a second face having means for receiving a registration device such as a shoulder screws threadable into the pump assembly, and means extending from the front face to the second face through the adapter for permitting a shaft to pass through from the pump to the motor/gear box assembly.

[0011] In accordance with another embodiment of the present invention, an apparatus for pumping materials, comprises driving means having an output shaft, pumping means having an input shaft matable with the driving means output shaft, and aligning means rigidly coupled between the driving means and the pumping means for aligning the driving means and the pumping means, and having a bore therethrough to permit at least one of the output shaft and the input shaft to pass therethrough.

[0012] In accordance with another embodiment of the present

invention, a method for connecting a motor/gear box assembly to a pump assembly comprises mounting an adapter body having a first face having a counterbore so that the counterbore receives a nose projecting from the motor/gear box assembly, and mounting the adapter body a second face having at least two mounting holes so that the mounting holes receive a registration device such as a shoulder screws threadable into the pump assembly.

[0013] In accordance with another embodiment of the present invention, a method for pumping materials, comprises driving a pump assembly with a motor/gear box assembly, and an adapter body coupling the motor/gear box assembly to the pump assembly using having a bore there through to permit at least one of the output shaft and the input shaft to pass therethrough.

[0014] There has thus been outlined, rather broadly, certain embodiments of the invention in order that the detailed description thereof herein may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional embodiments of the invention that will be described below and which will form the subject matter of the claims appended hereto.

[0015] In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of embodiments in addition to those described and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract, are for the purpose of description and should not be regarded as limiting.

[0016] As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a side view of a preferred embodiment of the invention including a motor/gear box assembly, a pump assembly, and an alignment adapter therebetween.

[0018] FIG. 2 is a side view of the arrangement of FIG. 1 with a portion cut-a-way to illustrate a shaft connection.

[0019] FIG. 3 is an end view of the arrangement of FIG. 1.

[0020] FIG. 4 is a front view of an alignment adapter according to a preferred embodiment of the present invention.

[0021] FIG. 5 is a cross sectional view taken through the line 5-5 in FIG. 4.

[0022] FIG. 6 is a rear view of the alignment adapter of FIG. 4.

[0023] FIG. 7 is a side view of the alignment adapter of FIG. 4.

[0024] FIG. 8 is a bottom view of the alignment adapter of FIG. 4.

[0025] FIG. 9 is perspective view of the assembly shown in FIG. 1.

[0026] FIG. 10 is a perspective view of the alignment adapter of FIG.

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DETAILED DESCRIPTION

[0027] Preferred embodiments of the invention provide an alignment device and method that can align a motor/gear box component with a pump component with an improved degree of accuracy and/or repeatability.

[0028] Referring now to the drawings, in which like reference numerals refer to like elements throughout, FIG. 1 illustrates an assembly 10 including a motor/gear box assembly 12 and a pump assembly 14. An alignment adapter part 16 connects the motor/gear box assembly 12 to the pump assembly 14.

[0029] The motor/gear box assembly 12 includes a motor 18 and a gear box 20. A preferred embodiment uses a conventionally available motor 18 and a generally known gear box 20, such as a parallel shaft gear box having a helical gear reducer. Referring now to FIG. 2, it can be seen that the gear box 20 has as its output a hollow or female final gear 22 which is adapted to receive a projecting or male shaft 23 which is a component of the pump assembly 14 and extends outward from the pump 14 assembly through the alignment adapter 16. A male shaft extends from the pump assembly 14 and is rotationally connected with the hollow output gear 22 so that the pump assembly 14 is driven by the hollow gear 22.

[0030] Also in FIG. 2, it can be seen that the front face of the gear box 20 includes a circular projecting nose 24. This nose 24 projects forward from the front face of the gear box 20 and is used for aligning the gear box 20 with the alignment adapter 16 in the fashion described in more detail below. The nose 24 can preferably be for example a “DIN B” type mounting flange such as a “ISOB14” flange.

[0031] Turning now to FIGS. 5-8, and particularly FIGS 6, 7 and 8, as illustrated, the preferred alignment adapter 16 includes a face 26 which abuts against the front face of the gear box 20. The face 26 has a flanged outer ring 28 and a pilot indentation 30, also referred to as a counter sunk pilot bore 30 which extends somewhat into the face 26. The pilot bore 30 is toleranced to be just slightly larger than the diameter of the nose 24.

[0032] The flange 28 has a number of mounting holes 32, six in the illustrated embodiment, which correspond to tapped holes in the face of the gear box 20. When bolts 34 are placed through the holes 32 and into the tapped holes in the face of the gear box 20 and tightened, the nose 24 is brought into tightly toleranced contact with the pilot hole 30 so that as the bolts are tightened the alignment adapter 16 affixed to the face of the gear box 20 rigidly and with a carefully toleranced position. The alignment adapter 16 has a central bore 34 therethrough which is large enough so that the shaft 23 extends therethrough so it can rotate without contacting it.

[0033] From the above it can be seen that a preferred method of affixing the alignment adapter 16 to the gear box 20 is provision of a nose 24 projecting from the gear box 20 that is received in a pilot counterbore in the adjacent face of the alignment adapter 16. While this arrangement is preferred, it will be appreciated that in some instances it may be desirable to reverse the orientations of the nose and the pilot counter bore respectively.

[0034] Returning now to FIG. 1, the alignment adapter 16 is attached to the pump assembly 14 also using bolts and bolt holes. However, the alignment is achieved differently for the pump assembly 14 than it is with respect to the gear box 20. More specifically, referring particularly to FIG. 4, in a preferred arrangement, four bolt holes 38 are provided along with two closely toleranced

pilot bolt holes 40. The pilot bolt holes 40 have a closely machined tolerance and each accept a shoulder screw to provide toleranced locationing of the alignment adapter 16 with respect to the face of the pump 14. Each shoulder screw has a toleranced dowel pin located between its head in its threaded portion. The threaded portion is threaded into tapped holes on the adjacent face of the pump assembly 14, and the dowel pin is closely dimensioned to the size of the respective hole 40.

[0035] In this way, the six fasteners 38 and 40 together provide the mounting force and also the precise alignment of the alignment adapter 16 to the pump assembly 14. The alignment adapter 16 has an aperture 46 extending through its front face 36 that is larger than the diameter of the pump shaft 23 so that the pump shaft 23 can extend therethrough and rotate without contacting it. Other registration devices or features can be used in place of shoulder screws, such as for example a mounting nose and counterbore; or dowel pins and bores; or ribs and complementary slots.

[0036] Returning now to FIG. 1, the assembly 10 rests on a cast base component 44. Preferably, the base component is a unitary cast item having two laterally spaced feet 46 at one end and two laterally spaced feet 48 at the other end. The base 44 is attached to the alignment adapter 16 via a bolt 50 which extends through a hole in the base 44 and into a threaded hole 52 provided at a flat face 54 of the alignment adapter 16 as shown in FIG. 8. The base 44 is also attached to the pump assembly 14 by two bolts 56 which extend through the base 44 and into tapped holes on the lower part of the pump 14. The motor gear box assembly 12 is not directly connected to the base 44 in the preferred embodiment, but rather has a clearance and is supported solely by its connection with the

alignment adapter 16 provided by the nose 24, counterbore recess 30, and bolts 34.

[0037] FIGS. 3 and 9 illustrates the assembled component including a material inlet 60 and a material outlet 62 of the pump assembly 14. The preferred steps for assembling the assembly 10 are as follows. First, the pump assembly 14 is obtained and the alignment adapter 16 is attached to it using the bolts 38 and 40. Next, the base 44 is also attached to the pump assembly 14. Lastly, the motor/gear box assembly 12 is attached to the alignment adapter 16 using the bolts 34.

[0038] In a preferred embodiment the alignment adapter 16 is constructed from ductile iron via an initial casting process followed by machining. In particular, the two locator holes 40 and the counterbore 30 are machined so as to have careful tolerances with respect to the shoulder screws and the nose 24 respectively. The adapter 16 is most preferably unitary, but can be a multipart component if desired.

[0039] It can be seen that various embodiments for the present invention can provide significant advantages over the prior art. For example, because some embodiments provide a relatively good alignment between the motor/drive assembly 12 and the pump assembly 14, it is possible to eliminate the need for a flexible coupling. Further, the process of connecting the components does not require any manual alignment checking steps on the part of the assembly operator. Further, the components can be disassembled from each other and reassembled without the need for any realignment process.

[0040] These benefits are accomplished at least in part by the use of a single, preferably unitary, alignment adapter part 16 which can be manufactured

using conventional manufacturing techniques and is more or less unsusceptible to wear since it has no moving parts.

[0041] Accordingly, various embodiments of the invention provide an economical, reliable, repeatable and easy to install alignment device and method for aligning a motor/gear box assembly with a pump assembly such as a positive displacement pump.

[0042] The many features and advantages of the invention are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the invention which fall within the true spirit and scope of the invention. Further, since numerous modifications and variations will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.